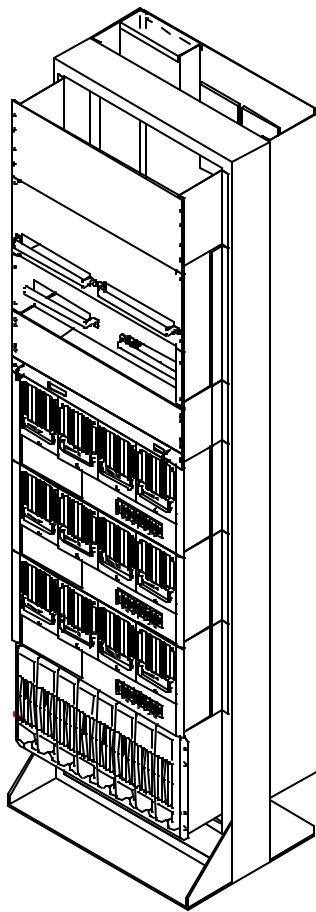




**DC POWER PLANT
PRODUCT MANUAL
MODEL MX28B1200/2400+27V**



APC DC Network Solutions Inc.
11035 Switzer Avenue
Dallas, TX 75238
800-800-4APC

Part Number 990-9166
Preliminary release

Product Structure

Component	Description	Part Number
MX28B1200/2400+27V Main Bay	1200 amp frame, 2400 amp carry through, controller. No rectifiers, converters, no distribution	0M-91147
MX28B1200/2400+27V Main Bay	1200 Amp expansion frame, No rectifiers, distribution.	Available soon
DC Distribution Options +24V	Main and/or extension Bay	
Small Breakers	38 +27V breakers and 8 –48V volt breakers	0M-91145
LVD Options +24V	Main and/or extension Bay	
No LVD		TBD
Battery LVD		TBD
Converter Shelf Option		
No Converters		TBD
Converter Shelf, Input power breakers, distribution breakers	Provides power to, and distribution from converters	0M-6176
Rectifiers	+27V @ 100 Amps each	1MRF28H27BV
Converters	-50V @ 10 Amps each	AAC-0010
Battery Temperature Probe	15 ft. (4.6m)	FFA-0013-1
	50 ft. (15.2m)	FFA-0013-2

*Note: DC-to-DC converters are available in the main frame only.

REVISION HISTORY

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1 GENERAL INFORMATION

1.1 Introduction

DC Power Plants from APC have unique features that make them easy to install, maintain, and upgrade. The rectifier units are modular and truly “hot-pluggable” into the shelf assembly without any separate AC wiring.

All system settings are made from the system control unit that provides monitoring and control functions for each component of the system as well as alarm listings for system diagnosis and maintenance.

The APC international network of sales and service offices and qualified representatives provides sales assistance for proposals, purchases, and after-sales support.

**APC provides nationwide 24-hour, 7-day service response by dialing:
(800) 800-4APC**

This service will answer your call, gather specific service information, and have a qualified APC service representative contact you as quickly as possible (refer to section on customer service and support).

1.2 Precautions

It is extremely important to read, understand, and strictly follow the instructions in sections on installation and setup. Also, please note the special SAFETY PRECAUTIONS outlined in Section 5.1.4 before beginning actual installation of the power system.

If any precautions are not clearly understood, or local conditions are not covered, contact the nearest APC representative or APC at (800) 800-4172 for clarification.

Also, refer to all applicable federal, state, and local regulations, and industry guidelines for correct installation of this power system.

1.3 Inspection upon Receipt of Goods

1.3.1 General

APC has taken precautions in packing the power equipment for shipment to ensure its safe arrival; however, the entire shipment including any boxes or crates should be inspected upon receipt for evidence of damage that may have occurred during transit.

1.3.2 Visible External Damage

It is the responsibility of the person receiving the shipment to inventory and inspect all materials against the bill of lading or waybill provided **IMMEDIATELY** upon taking delivery while the carrier representative is **STILL ON SITE**. Please be sure that all items are accounted for, including the correct number of pallets and the quantity of accessory and/or component boxes. Also, note any visible external damage that may have occurred during transit.

If damage has occurred or the quantity of items is not correct, then:

- 1) Make a descriptive notation on the delivery receipt before signing.
- 2) File a damage or shortage report with the carrier that delivered the shipment.

1.3.3 Concealed Damage

It is the customer's responsibility to unpack the power system and equipment received from APC and check for concealed damage. Within 15 days of receipt, check the materials received against the detailed packing list to verify that the quantity and condition are complete and satisfactory.

Again, note any damage to the internal packing material and/or material shortages. If damage or shortage is noted, then:

- 1) Request an inspection by the carrier;
- 2) File a concealed damage claim; and/or
- 3) File a material shortage claim with your APC representative.

DELAY IN NOTIFYING THE CARRIER MAY RESULT IN LOSS OF RIGHT TO REIMBURSEMENT FOR DAMAGES OR LOSS.

If you are unsure about the appearance of a part while conducting the materials inventory and inspection, refer to the manual or contact the Customer Service Department of APC

Should you have any questions concerning potential damages or should you experience a lack of cooperation from your carrier, please contact your APC representative, or call APC

1.3.4 Return of Damaged Goods

Should equipment be damaged and require return to APC for repair, the APC service representative will provide instructions along with a valid returned material authorization (RMA) number to facilitate return of the damaged goods to the APC repair center.

It is important that the steps outlined in Section 1.3.2 and Section 1.3.3 above are followed carefully. Your APC representative will assist you, if required, in obtaining proper disposition of an initial delivery return issue; however, a valid RMA number must be obtained before returning any equipment to APC.

2 CUSTOMER SERVICE AND SUPPORT

APC manufactures a line power plants and provides customers with complete product and systems support and service. APC has an international network of factory trained service technicians. The service organization is on call 24 hours a day, 365 days a year.

If there is a problem with the power system, contact APC at

(800) 800-4APC

Units returned for repair can be turned around within 24 to 48 hours of receipt at the factory location. Shipment should be sent pre-paid. The unit will be returned pre-paid provided it was received that way.

An RMA must be obtained for all equipment returned to APC. It is important that correct procedures be followed in filing an RMA, including providing an accurate written description of the problem. An accurate written problem description will help ensure that the unit will be properly repaired.

If a unit is returned and a “No Fault Found” results, APC reserves the right to bill the customer for labor and assess a service charge to cover extra costs incurred.

3 WARRANTY PROVISIONS

3.1 General Provisions

APC warrants the power equipment and components it manufactures or sells against defective materials and workmanship for a period of TWO (2) YEARS from the date of shipment.

3.1.1 Warranty Returns

If initial physical inspection results in identification of a material or workmanship flaw(s) that could impair product performance as defined by APC’s electrical and physical specification in effect at the time of shipment, and if this flaw(s) is not due to transportation damage or installation abuse, contact APC or call the 24-hour emergency number, (800) 800-4APC, to request assistance.

You will be provided either a) an RMA number with instructions for return of the equipment or component(s) to the APC factory service center, FOB destination, freight pre-paid, for examination, or b) for non-returnable systems and equipment, notice to wait until an APC authorized service representative arrives at the site to inspect the equipment. Repaired or advance replacement modules or circuit components will normally be available within 24 to 48 hours of receipt of equipment or RMA.

3.1.2 Warranty Repair or Replacement

If, during the warranty period, the supplied equipment is found to be physically or electrically faulty due to defective materials or workmanship on the part of APC, the defective product(s) or component(s) will be repaired or replaced at the sole option of APC without charge to the user for replacement materials or repair labor. (The procedure outlined above for contacting APC must be followed.) Costs incurred for replacement installation including, but not limited to, installation equipment, travel expenses of an APC representative(s), and costs of installation material transportation expenses are not the responsibility of APC. Any replacement product(s) or component(s) shall only complete the remaining unused portion of the original warranty of the replaced product(s) or component(s).

3.2 Exclusions and Limitations

1. This warranty applies only to the original US domestic purchaser (user) and is not transferable internationally, except with expressed written consent from APC facility in Dallas, Texas.
2. APC reserves the right to void the warranty if identification marks or serial numbers have been removed or tampered with, or the defect is determined to have been caused by misuse, neglect, improper installation, environmental conditions, non-authorized repair, alteration, or accident.
3. This warranty does not cover physical damage due to the acts of nature or man that stress the equipment or component(s) beyond design limits and exert undesirable influence aside from normal wear and tear.
4. APC assumes no responsibility for any work accomplished or expenses incurred except with expressed written consent from APC
5. APC shall not be liable to the user (purchaser) or any third party for indirect, incidental, or consequential damages such as, but not limited to, loss of use, loss of profits, costs associated with removal/installation of a defective product(s) or component(s) arising out of the sale or relating to the use of this product, and the user (purchaser) assumes responsibility for all personal injury and property damage resulting from the handling, possession, or use of the product. In no event shall the liability of APC for any and all claims, including claims of breach of warranty or negligence, exceed the purchase price of the product that gave rise to the claim.

The above warranty is in lieu of all other remedies, including actions for contract or negligence.

All other warranties, expressed or implied, including but not limited to the implied warranties of merchantability and fitness for a particular purpose, are hereby excluded.

4 PRODUCT OVERVIEW AND TECHNICAL DESCRIPTION

4.1 Description

The APC Models MX28B1200+27V represents a family of stand-alone +24V DC power plants. Through the use of modular power, a system is configurable in such a manner that it will support most typical applications within the specified current range of up to 1200 amps without special application engineering or assistance. The expansion bay, which will increase the output to 2400 Amps, will be available shortly.

The system is capable of supplying 1200 amps of +24V DC power in a single frame with integrated power distribution and an advanced control and monitoring module. Standard distribution for a power bay includes up to 38 plug-in circuit breakers ranging from 1 to 100 amps. An optional +24V to -48V Converter shelf is available to power up to 80 Amps of -48V loads that can be distributed by up to 7 circuit breakers. An optional low voltage disconnect (LVD) can be provided on the battery side. A 1200 amp MX28B+27V with converters is shown in. Figure 4-1. A block diagram is shown in Figure 4-2

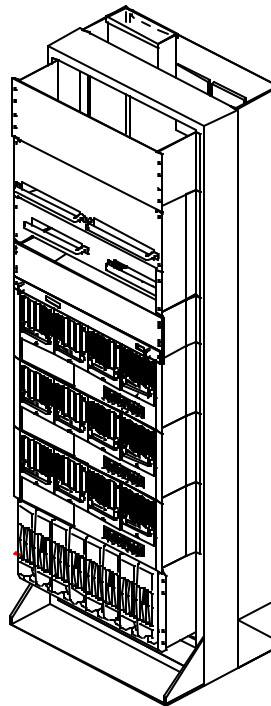


Figure 4-1 MX28B-1200/2400+27V

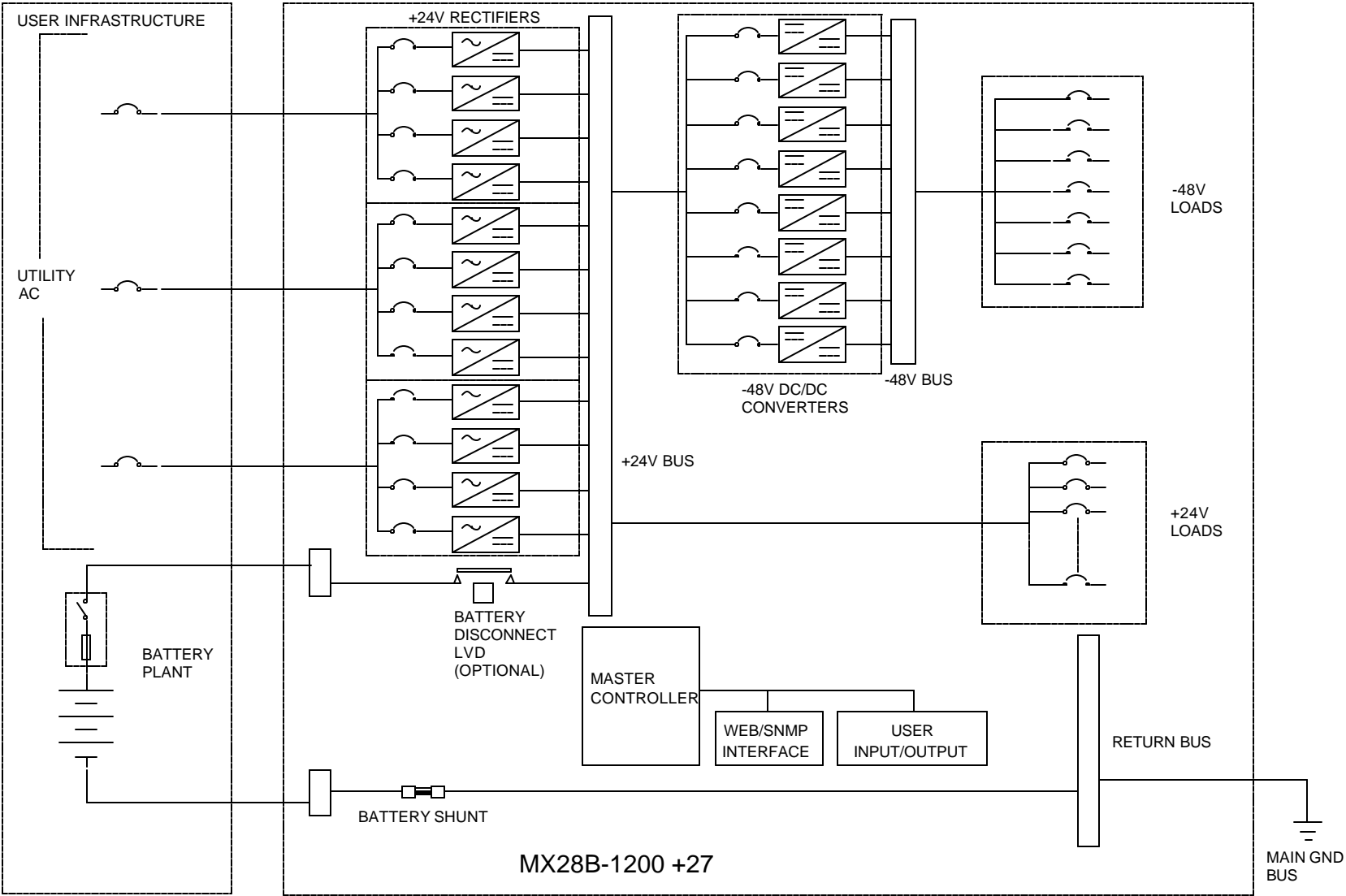


Figure 4-2 MX28B1200/2400+27V System Diagram

4.2 Power Output Capacity

A power frame consists of three rectifier shelves, each shelf accommodating up to four hot-plug, 100 amp rectifiers. A completely configured power frame with 12 rectifiers is rated at 1200 amps. The master control unit provides control and monitoring for the entire system.

The optional converter shelf supports up to eight hot-plug +24/-48V DC/DC converters. Each converter is rated at 10 Amps.

4.3 Rectifiers

APC Model MRF28H27BV with specifications as follows:

- Input Voltage: 176-264V ac (230V ac nominal) @ 45-66 Hz
- Input Current per Rectifier: 13.9 Amps @ 230V ac
- Apparent Power Factor: 99% Typical, 98% Minimum
- Output Voltage: 27.2V DC
- Overvoltage Protection: Set at 31.5V DC
- Output Current per Rectifier: 100A Minimum Continuous
- Power Output per Rectifier: 2800W Continuous, $V_{in} > 198V$ ac
- Efficiency: 89% Typical
- Cooling: Fan cooled, front to rear airflow
- Ambient Temperature: -25°C to 55°C Operational

4.4 Converters

APC Vector Series with specifications as follows:

- Input Voltage: +20V DC to +30V DC
- Input Current per converter: <30 amps
- Output Voltage: -50VDC (-48V DC to -52V DC)
- Output current per converter: 10 amps
- Power output per converter: 520 Watts
- Efficiency: >85%
- Cooling: Fan cooled, front to rear airflow
- Ambient temperature: -40°C to 55°C Operational

4.5 Control Unit

The microprocessor-based power system control unit is 1U high (1.75") and provides control and monitoring functions. Features implemented are:

- 32-character alphanumeric display (2 lines by 16 characters)
- LED alarm and status indicators
- Standard voltage and battery charging control
- Battery temperature compensation (optional temperature probe)
- Monitoring of up to 6 shelves of four rectifiers each and up to 8 DC to DC Converters
- Individual alarm monitoring of 72 breakers
- Individual alarm monitoring of 16 power distribution fuses
- Eight alarm / annunciation relays (Major, Minor, and six user defined) with form C contact outputs
- Four external alarm inputs (either N.O. or N.C. contacts)
- Control for two independent Low Voltage Disconnects (LVD's)
- WEB/SNMP Interface Card for remote monitoring

4.6 AC Input Power

Each rectifier shelf requires 208/220/240V ac, single-phase, 50/60 Hz, supplied through an external 80-amp breaker. Three Vertical wire conduits in the left rear of the frame provide routing for AC input power connection of each shelf. The Earth Ground wiring is factory installed to each rectifier shelf. A power entry box with 3 pilot holes is provided at the top and rear of the frame where AC wiring conduit can be run. Refer to Figure 4-3.

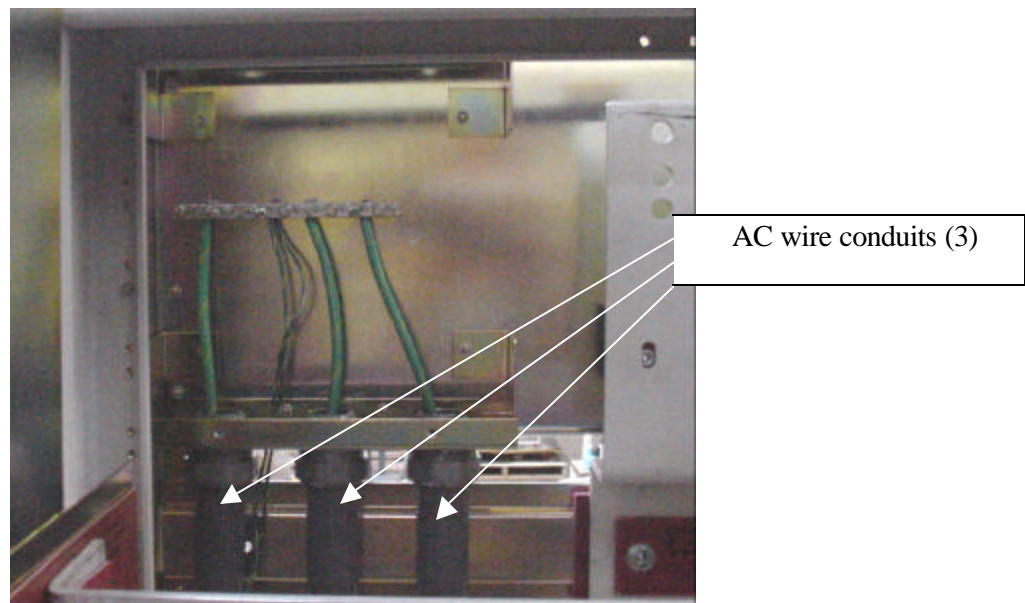


Figure 4.3 Power Entry Box

4.7 Battery connections

Battery connections are made at the top rear of the unit. The +24V and Battery Return buses each provide two sets of 3/8"-16 holes on 1 inch or 1 3/4 inch centers for connecting two-hole battery cable lugs. Refer to Figure 4-4.

A battery disconnect breaker is required external to this equipment. The power plant can monitor auxiliary contacts from this breaker. Battery temperature compensation is available. APC's master control unit, in conjunction with the optional temperature monitor sensor cable, is used to implement this function.

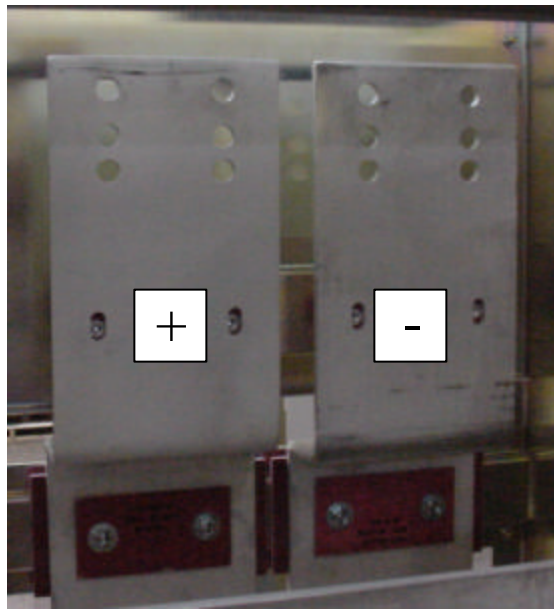


Figure 4.4 Battery Connections

4.8 +24V DC Distribution

A standard power distribution module can mount up to 38 plug-in circuit breakers providing +24V power for customer loads. Each breaker row is connected at its center to the +24V DC bus, with each column having an ampacity of 300A. Connections for the +24V DC loads are located directly above the corresponding breaker. A typical load connection would utilize a #6 AWG wire with a two-hole lug on 5/8-inch centers, attached with standard #10-32 mounting screws.

The load return cables for each circuit breaker connect to a return bus directly above the top row of circuit breakers. The return bus contains a pattern for 40 two-hole #10-32 lugs on 5/8-inch centers. Figure 4-5 shows the power plant's DC distribution section.

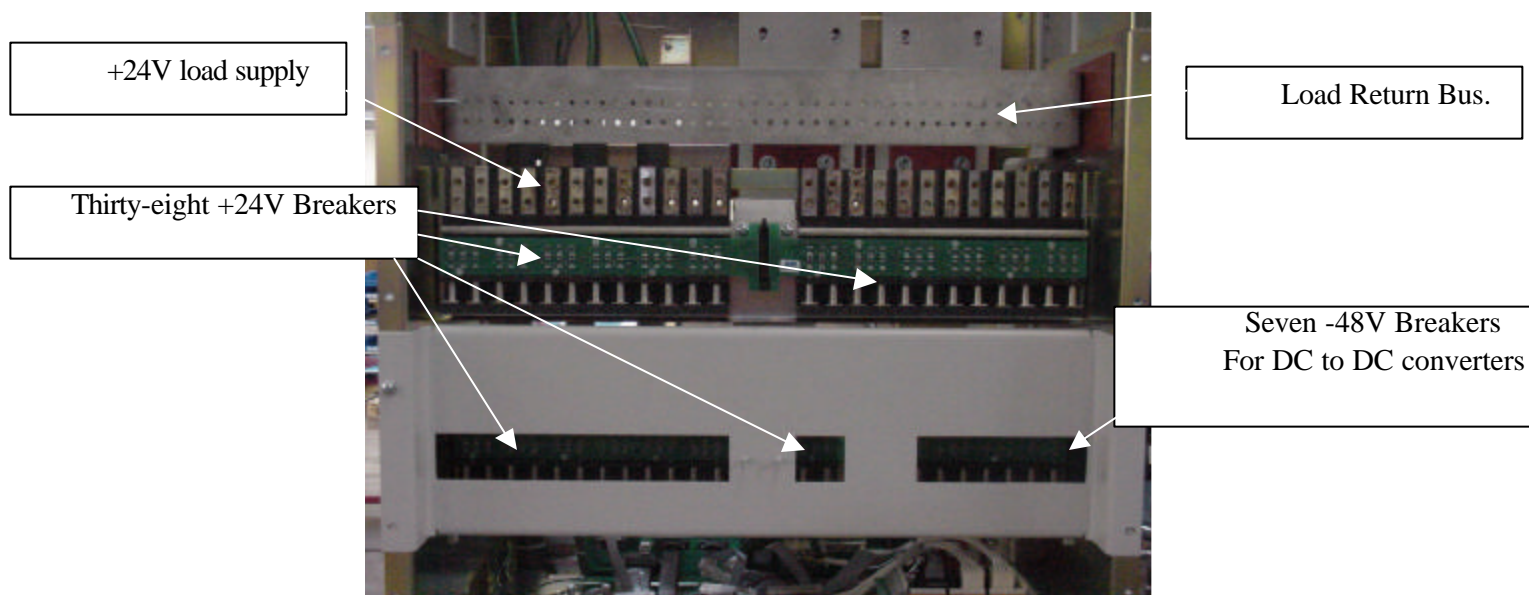


Figure 4.5 DC Distribution.

4.9 –48 V DC Distribution from Converters (Optional)

Up to eight 24V/-48V dc converters can be used to supply power for –48V loads in increments of 10 Amps each. These converters are mounted at the bottom of the unit. Each converter is powered via a circuit breaker located directly below. See figure 4.6



Figure 4.6 DC-to-DC Converters.

4.10 Environmental

- Ambient Temperature: -4°F to 149°F (-20°C to +65°C) operating
-40°F to 185°F (-40°C to +85°C) storage
- Humidity: 0% to 85% RH non-condensing operating
0% to 95% RH non-condensing storage
- Altitude: Up to 10,000 feet (3000m) operating
Up to 33,000 feet (10,000m) storage

4.11 Mechanical

- Weight: Power Frame – 550 to 600 lbs. (250 to 272 kg)
Rectifier - 11 lbs. (5 kg.)
Converters – 7.2 lbs. (3.3 kg.)
- Dimensions: Frame: 84” high x 24.25” wide x 18” deep
(2134 mm x 616 mm x 457 mm)
- Color: Dawn Gray (fronts)

4.12 Compliance

- Safety: UL-1950 (Pending)
- NEBS: Level 1 (Pending)

5 INSTALLATION PROCEDURES

5.1 Preparation

5.1.1 Recommended Tools

- Standard selection of insulated hand tools.
- Proper tools for crimping the selected cable lugs.

5.1.2 Recommended Test Equipment

- Digital Multimeter

5.1.3 Equipment Inspection

Remove equipment from packing material and inspect for shipping damage to verify the safety and operational suitability for the installation site. *[Refer to Section 1.3]*

5.1.4 Safety Precautions

***** WARNING *****

The power plant is supplied from a nominal 230V AC, 50/60 Hz source. Keep All AC input enclosure covers in place when the system is operational or energized.

***** CAUTION *****

Handling or touching the controller boards located inside this unit without being electrostatically discharged (grounded to the frame) may cause extensive damage to the electronics. Before touching or handling the controller boards, it is recommended that an ESD wrist strap be utilized.

***** WARNING *****

Hazardous energy levels are present on bare conductors in the +24 and -48V DC distribution connection areas of the plant. Accidental shorting of distribution conductors can cause arcing and high currents that can cause serious burns or other physical harm.

It is recommended that:

- Any jewelry, rings or watches be removed while working on this equipment.
- Handles of all wrenches, screwdrivers, cutters and pliers be insulated.
- Shafts of screwdrivers be wrapped in electrical tape or otherwise insulated.

5.1.5 Room/Locations

NOTE: The APC Model MX28B1200/2400+27V DC power plant is to be installed in a room, vault, or similar enclosure that is accessible only to qualified persons in accordance with the NEC or the authority having jurisdiction.

Prior to installation, drawings, floor loading requirements, external alarm points, AC service entrance, and grounding schemes should all be checked and confirmed. If batteries are to be mounted in a room separate from the power plant, careful attention should be paid to battery cable voltage drop effects. Environmental operating temperatures and ventilation/cooling considerations should also be noted, not just for the power system but also for all other equipment that may reside in the power room area.

5.1.6 Mounting

The unit is designed to be bolted to the floor of the housing structure. Figure 5-1 shows the footprint of the frame and the mounting points with dimensions. Consult the system design specifications to see if it is necessary to electrically isolate the frame from the floor structure. This is required in many installations.

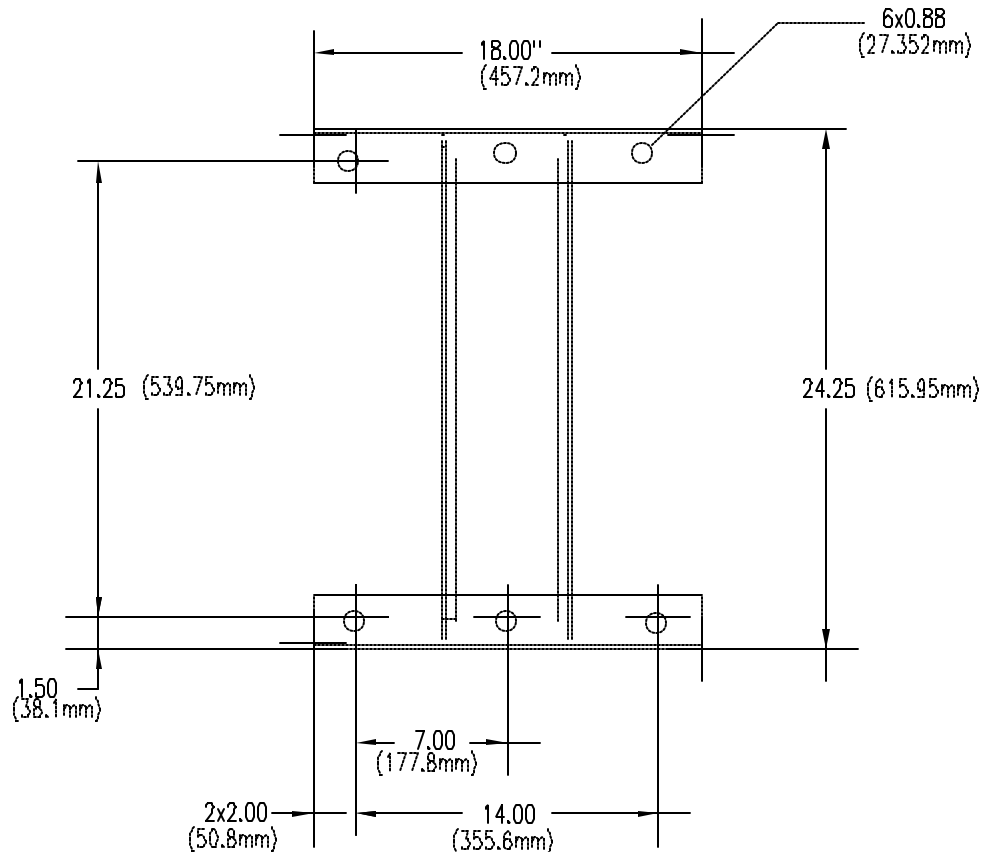


Figure 5-1 Floor Mounting Dimensions

5.1.7 Ventilation

The rectifiers have fans that provide front to rear airflow for internal cooling. The MX28B1200 housing should be mounted to allow free airflow from the front and out the top of the unit. *[Refer to Section 4.10 for environmental characteristics.]*

5.2 AC Service and Ground Connections

***** WARNING *****

Ensure that all of the DC and external AC circuit breakers are in the OFF position prior to connecting service to the power plant. Confirm that all voltages have been removed including any battery sources before proceeding.

The MX28B DC power plant requires the supply of 208/220/240V AC, single-phase, 50/60 Hz power through individual external 80-amp circuit breakers to the AC input terminal block connections for each rectifier shelf in the system. Each rectifier shelf has four 20-amp breakers, each serving one rectifier. The AC Grounding wiring, from the Earth terminal block to the individual shelves is factory installed for each shelf installed. Connections to the AC input connector for each rectifier, is factory installed.

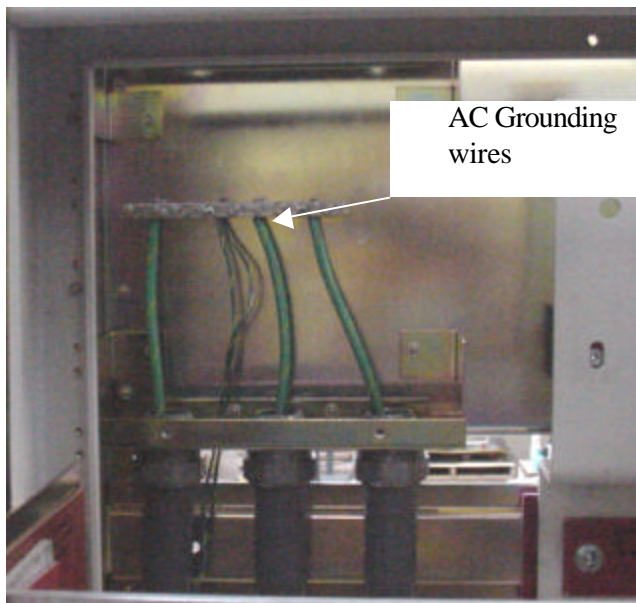


Figure 5-2 AC Wiring conduit

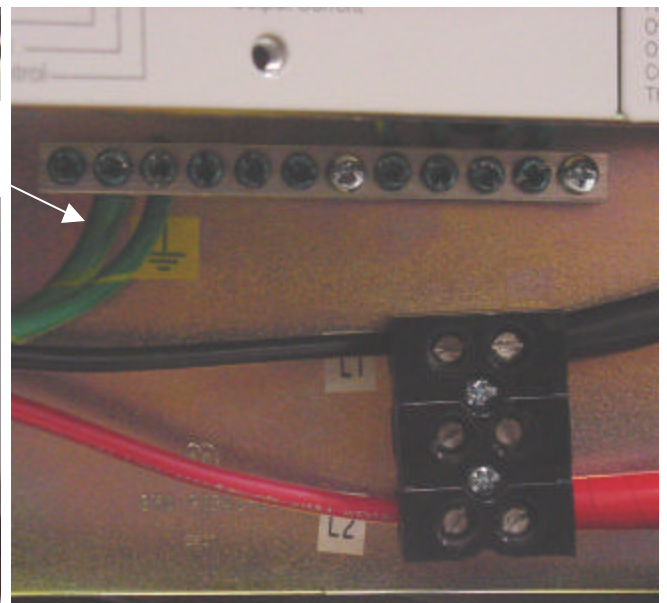


Figure 5-3 AC Wiring Terminal

The AC input enclosure, located at the top rear of the MX28B housing, is provided with three pilot holes in the top for attaching external conduit (Figure 5-4), and three 1-inch conduits exiting the bottom for AC wire. AC wiring passing through the conduit will be routed through the access opening in the AC input enclosure into the wiring area where a safety ground bar and rectifier input terminal blocks are located. The terminal blocks are labeled as “L1” and “L2/N” for connection of the two AC wires (Figure 5-3). Each terminal block represents connections for all 4 rectifiers in the shelf.

The suggested wire size for L1, and L2 is #4 AWG rated at 105°C; however, the ambient temperature and number of wires in a conduit must also be considered in accordance with NEC requirements. Be sure to follow any local electrical wiring codes. Terminate the ground wire in the AC box at the top of the unit to the ground terminal block. Continue to run the remaining two wires into the individual conduits to each rectifier shelf. Connect them to L1, and L2 of the terminal block behind the access plate.

If the AC input power is provided from a three-phase distribution panel, the circuit breaker positions should be selected such that the load is balanced as much as possible.

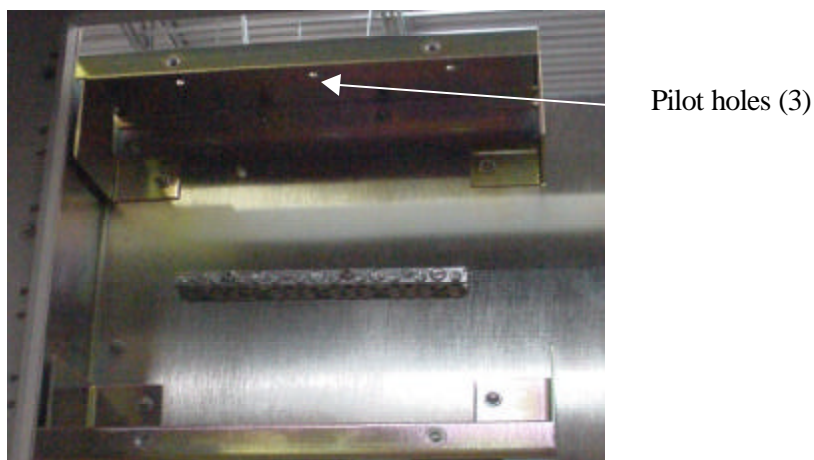


Figure 5-4

5.3 Battery Connections

5.3.1 Battery Disconnect

An external circuit breaker or fused disconnect (not supplied) is recommended in the positive line (located at the battery end) to protect the cables from the battery to the MX28B DC power plant. The power plant can monitor auxiliary contacts from this breaker. Selection of a circuit breaker or fuse for a battery string should take into account maximum battery short circuit current and cable sizing.

5.3.2 Cable Sizing Considerations

The battery cable(s) should be sized sufficiently large to limit the voltage drop from the MX28B DC power plant to the battery during charging per system design requirements. The cable(s) must also carry the full load current during battery operation. If assistance is required to determine the necessary cables for the application, contact your sales representative or APC.

5.3.3 Connecting the Cables

The battery cable connections are located at the top rear of the unit as shown in Figure 5-5. The battery negative (return bus) and battery positive (+24V) buses each provide two sets of 3/8"-16 holes on a double pattern one-inch and 1 3/4-inch centers for connecting two-hole battery cable lugs. Connect the battery cables as applicable using 3/8"-16 bolts (not provided) and tighten them with a torque wrench to 200 in-lbs.

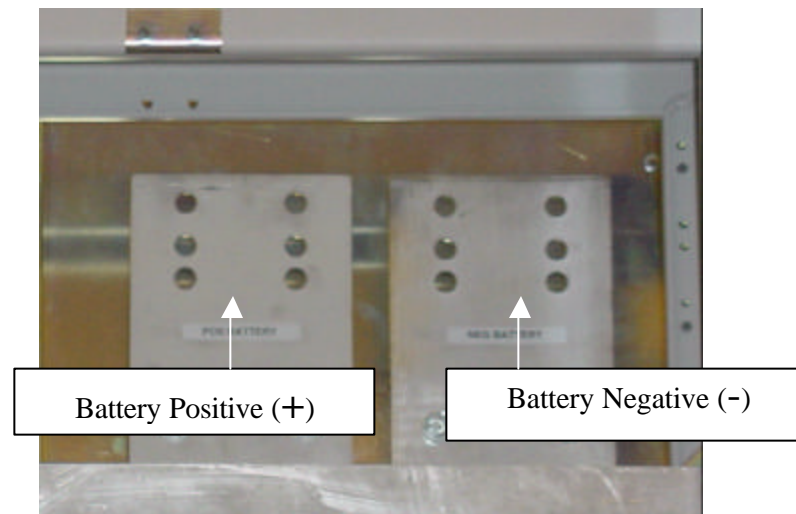


Figure 5-5 Battery Connections

******* CAUTION *******

Make certain that the battery polarity is correct when making connections to the Model MX28B DC power plant. Incorrect connection could cause severe equipment damage.

5.4 DC SYSTEM GROUNDING

THE NEGATIVE LOAD CONNECTION (RETURN BUS) FOR THE POWER PLANT MUST BE CONNECTED TO THE FACILITY MASTER STATION GROUND. THE CONNECTION SHOULD BE MADE ON THE RETURN BUS IN THE BASE UNIT DISTRIBUTION AREA. DETAILS FOR THIS CONNECTION SHOULD BE PROVIDED IN THE SITE ELECTRICAL GROUNDING PLANS.

5.5 Rectifier Installation

The rectifiers are shipped in separate containers. Follow the procedure below to install a rectifier.

- 1) Remove the rectifier from its shipping box.
- 2) Slide the rectifier into the shelf between the guides until fully seated.
- 3) Fasten the rectifier in place with the rectifier retaining screw included in the shipment.

Since all adjustments are made from the system control unit, no rectifier adjustments are necessary.

NOTE: All “FLOAT” – “BOOST/EQUALISE” switches (one is located on the front of each rectifier in the system) must be set to “FLOAT” to allow the MX28B to control the output voltage properly.

5.6 Converter Installation

The converters are also shipped in separate containers.

- 1) Remove the Converter from its shipping box.
- 2) Slide the converter into its shelf until fully seated.
- 3) Tighten the retaining screw mounted on the lower front on the converter.

5.7 Alarm Connections

The alarm connections for all rectifiers, breakers, and fuses are factory pre-wired. The MX28B DC power plant, however, permits the user to program the system alarms in various ways. A Printed Circuit (PC) board designated “0P9133” is mounted in the space above the master control unit and provides terminal block connection points for alarm outputs and alarm inputs (Figure 5-7). These cage-clamp terminal blocks are operated by pushing back the lever, inserting the wire and then releasing the lever to clinch the connection. Recommended wire size is #28 AWG to #20 AWG.

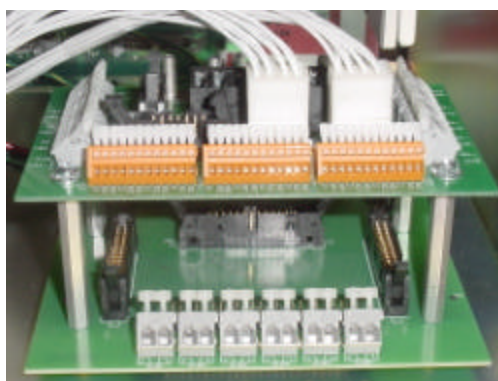
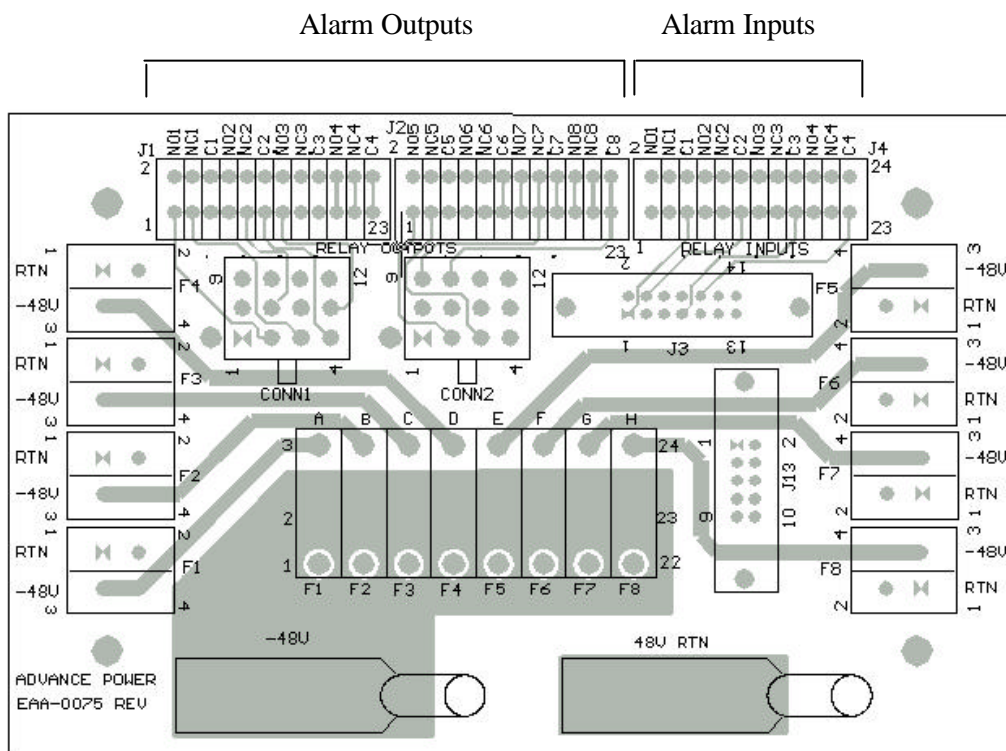


Figure 5-8 Alarm Interface PC Board

5.7.1 External Alarm Inputs

Four external alarm inputs with assignable priority levels are available. These alarm inputs respond to external dry contact closures between normally open (NO) and common (C) or contact openings between normally closed (NC) and C (see Table 5-1).

External Alarm Source (non-alarm state)	Connect To Input Alarm Terminals
OPEN	NO-C
CLOSED	NC-C

Table 5-1. External Alarm Input Definition

Table 5-2 shows the external alarm input connection designations. Connector J4 is located on the alarm interface board mounted in the space above the control unit. Systems are shipped with jumper wires connecting each NC and corresponding C contact. A jumper wire should be removed only if the corresponding NC-C contacts are going to be used.

EXTERNAL ALARM INPUT	J4 TERMINAL DESIGNATION (NO-NC-C)	USER ALARM NOTES
#1	NO1-NC1-C1	
#2	NO2-NC2-C2	
#3	NO3-NC3-C3	
#4	NO4-NC4-C4	

Table 5-2. External Alarm Input Connections

5.7.2 Alarm Outputs

There are eight alarms available that provide outputs via Form “C” relay contacts. The last two of these are pre-assigned as the Minor and Major alarm outputs. **The Major relay is energized (NO-C contacts closed) during normal (non-alarm) operating conditions**; all the other relays energize when an alarm condition occurs. The other six outputs are initially designated as “Relay 1” through “Relay 6” (the user may assign more meaningful names if desired). The various system alarm conditions can be assigned to any of the eight alarm outputs.

Table 5-3 shows the alarm output connection designations. Connectors J1 and J2 are located on the alarm interface board mounted in the space above the control unit. The relay contacts should only be used to switch resistive loads of 0.5 amperes or less at 60 volts or less.

ALARM OUTPUT	TERMINAL DESIGNATION NO-NC-C	USER ALARM NOTES
RELAY #1	J1 NO1-NC1-C1	_____
RELAY #2	NO2-NC2-C2	_____
RELAY #3	NO3-NC3-C3	_____
RELAY #4	NO4-NC4-C4	_____
RELAY #5	J2 NO5-NC5-C5	_____
RELAY #6	NO6-NC6-C6	_____
MINOR	NO7-NC7-C7	_____
MAJOR	NO8-NC8-C8	_____

Table 5-3. Alarm Output Connections

5.8 Connecting The Loads

5.8.1 DC Circuit Breakers.

Various circuit breakers can be installed in the MX28B power plant for DC distribution circuit protection. Available plug-in circuit breakers are shown in Table 5-4. Plug-in circuit breakers rated at 60A or more require two mounting positions and require a breaker adapter kit, which is included (see kit selection information below the table). The breaker adapter kit includes all necessary mounting hardware.

BREAKER RATING	PART NUMBER		BREAKER RATING	PART NUMBER
1 A	FFA-0014		40 A	FFA-0020
3 A	FFA-0015		50 A	FFA-0025
5 A	FFA-0016		60 A	FFA-0021-X *
10 A	FFA-0017		70 A	FFA-0022-X *
15 A	FFA-0028		80 A	FFA-0023-X *
20 A	FFA-0018		100 A	FFA-0024-X *
30 A	FFA-0019			

- * -1: adapter has #10 studs on 5/8" centers for two-hole cable lug
 -2: adapter has #10 studs on 3/4" centers for two-hole cable lug
 -3: adapter has 1/4" studs on 1" centers for two-hole cable lug

Table 5-4. Plug-in Circuit Breakers

5.8.2 Installation of Circuit Breakers

- 1) Remove the metal circuit breaker cover panels.
- 2) Use diagonal cutters to cut the metal web of the breaker panel “knock-outs” at the desired breaker locations.
- 3) Install the circuit breaker(s) by snapping the top terminal onto the upper bus bar and rotating the unit down until the second terminal snaps onto the breaker termination post as shown in Figure 5-8. The breaker alarm terminals are designed to make contact with the alarm terminal board as the breaker is snapped into place.

NOTE: Circuit breaker alarm contacts close when the circuit breaker is tripped but not when it is turned OFF.

***** CAUTION *****

During circuit breaker installation, carefully align the breaker alarm terminals with the alarm terminal board to avoid breaker terminal damage.

- 4) Reattach the circuit breaker cover panels.

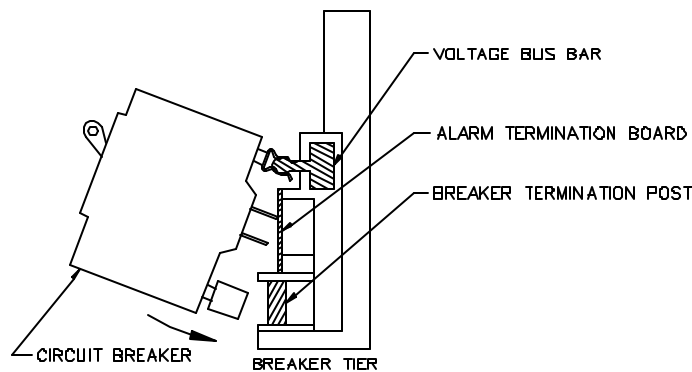


Figure 5-8 Plug-in Circuit Breaker Insertion

5.8.2.1 24V Circuit Breaker Load Connections

Connections for the +24V DC loads are located directly above the corresponding breaker. A typical load connection would utilize a #6 AWG wire with a two-hole lug on 5/8-inch centers, attached with standard #10-32 mounting screws.

The load return cables for each circuit breaker section connect to the return bus directly above the top row of circuit breakers. These return buses contain patterns for 40 two-hole #10-32 lugs on 5/8-inch centers.

5.8.2.2 –48V Circuit Breaker Load Connections

Connections for the –48V DC loads are made directly above the corresponding breaker. A typical load connection would utilize a #6 AWG wire with a two-hole lug on 5/8-inch centers, attached with standard #10-32 mounting screws.

The load return cables for each circuit breaker section connect to the return bus located above the upper circuit breakers.

5.9 Battery Temperature Probe Installation

The optional temperature probe is used to monitor the battery string temperature. To get the most representative temperature measurement, the probe should be placed in contact with a battery cell that is centrally located. The probe should be placed directly in contact with the cell (not the frame surrounding the cell). Generally, the cell cover can be used; be careful not to allow the probe body to touch the terminals.

- 1) Plug the connector end of the temperature probe into J5 on the left side of the control unit backplane card in the base power bay.
- 2) Route the cable as required to position the probe on the selected battery cell
- 3) Remove the adhesive protection strip from the probe body and press the adhesive side of the probe on the battery cell cover.

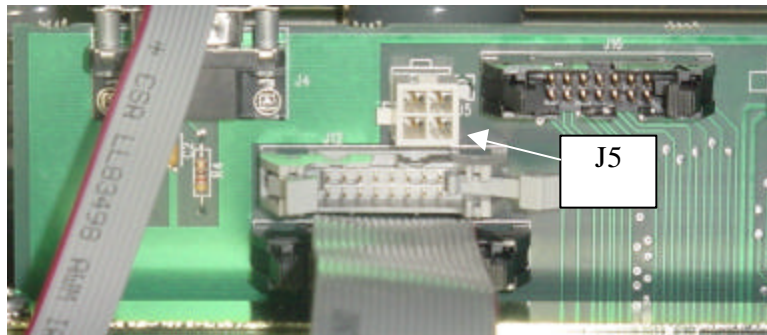


Figure 5-10 J5 Location

5.10 Power-Up and Checkout

Before initiating power-up and checkout, ensure that the following conditions exist:

- 1) Make sure that the external circuit breaker or fused disconnect protecting the cables from the battery to the power plant is turned **OFF** (the battery cables should be connected to the power plant, but the battery should **not** be connected).
- 2) Make sure that all load circuit breakers are turned **OFF** and all load distribution fuses are removed.
- 3) Verify that all rectifiers have been installed.
- 4) Verify that converters if installed are set to ON and have their respective breakers ON.

5.10.1 Apply AC Power

Turn on the circuit breakers that supply AC power to the rectifier shelves in the MX28B DC power plant. Turn on the individual 20 Amp circuit breakers for each rectifier on the shelf. The main screen should appear on the control unit display (see Figure 5-10). The display on the control unit is a 2-line by 16-characters display. The cursor cycles below the characters of the active selection on the display. Information shown in the second line of Figure 5-10 that extends beyond 16 characters (to the right of the “S” in “ALARMS”) can be viewed on the control unit display by using the scrolling controls (refer to Section 6 for operation of the control unit).

NOTE: When AC power is initially applied, there is a 60-second period during which no alarms are reported.

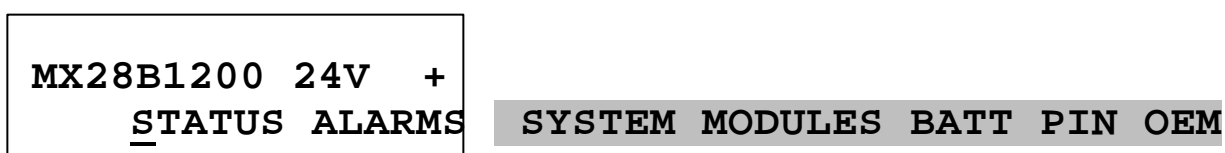


Figure 5-11 Control Unit Display

5.10.2 System Parameters Verification/Adjustment

The MX28B system control unit is delivered with pre-programmed parameter default settings. A complete listing and description of all system configuration parameters as well as displayable system status and information is provided in Section 6. Read Section 6 to gain an understanding of and how to use the operational features provided by the MX28B DC power plant. As a minimum, the following parameters should be verified and adjusted, if required, before connecting batteries or loads to the power plant:

- 1) **Battery Float Voltage** - default = +27.00V DC (Check the manufacturer's recommendation for the batteries being used in the system.)
- 2) **Battery Maximum Recharge Rate** - default = 200A. (Bellcore specifications recommend a maximum charging rate of battery capacity (in Ampere-hours) divided by 20 hours; check the manufacturer's recommendation.)
- 3) **System Voltage** - measurement \cong +27.00V DC (This is a measurement by the system of the DC output bus voltage.)
- 4) **LVD Option** - default = "Enable" (If the MX28B does not have an LVD installed, this should be changed to "Disable".)
- 5) **Rectifier Information** - Check the rectifier information displays to verify that all rectifiers installed can be viewed on the control unit display and that no rectifier alarms are active.

Section 6 provides location information for these parameters and how to make changes if required.

5.10.3 Full System Power Up

To complete a full system power up, perform the following steps

- 1) Turn **OFF** all the circuit breakers that supply AC power to the rectifiers in the MX28B DC power plant.
- 2) Turn on the external circuit breaker from the battery to the power plant.
- 3) Turn on all the circuit breakers that supply AC power to the rectifiers in the MX28B DC power plant.
- 4) Load circuit breakers may now be turned on and inserted as required.

6 SETUP, ADJUSTMENTS, AND OPERATION

6.1 User Interface

The MX28B control unit provides a user interface designed with a hierarchical menu that can be viewed on the 32-character display by “navigating” with the “←” (left), “→” (right), “↑” (up), and “↓” (down) arrow keys located on the front panel. The selected item on the display is identified by the cursor cycling beneath its characters.

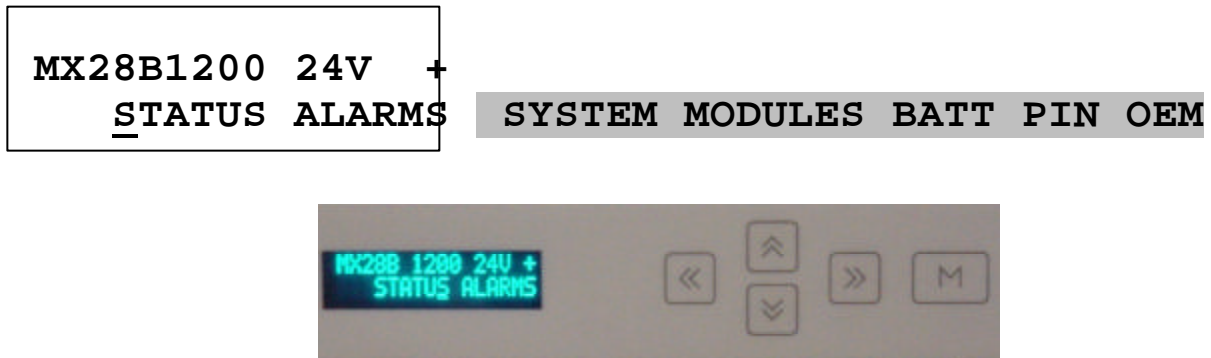


Figure 6-1 Navigating the Menu

The “M” (Modify) key and the arrow keys are used to set parameters and text to customize the system operation for a specific application. Items that can be modified have “m+” in the upper right corner of the display. If a security level higher than the one presently set is required to modify the parameter, “s+” is displayed instead of “m+”. Status, alarms, and information screens have “+” in the upper right corner of the display (or “#” in the case of rectifier information screens) and cannot be modified. When AC power is initially applied, there is a 60-second period during which no alarms are reported.

Pressing the “M” key on the front panel will change the “m+” to “M+”, indicating that the parameter can now be changed using the arrow keys. Some parameters can be changed to other predefined selections by pressing the up or down arrow keys to display an alternative selection. These parameters can be recognized after the “M” key is pressed by the cursor cycling beneath the characters of the selection. For other parameters, such as text and most numeric values, after the “M” key is pressed the cursor will be displayed under an individual character. The right or left arrow key is used to position the cursor below the character to be changed and the up or down arrow key is used to “spin” the digit or letter to the desired value. When the desired changes have been made to an individual parameter screen, the “M” key is pressed again; the “M+” changes back to “m+” and the new entry is stored in memory.

If the user plans to make any changes to system parameters, the first item that should be verified or entered is the appropriate password for the security level required for the parameters to be modified. Security level 2 enables modification of all variable system parameters; level 1 permits modification of some parameters; no security is required for viewing status items. The security level password is entered through the “PIN” screen. If no front panel keys are pressed for 60 minutes, the active password reverts to “0000” and “|APC|” begins to move about the display. Pressing any key returns the display to normal; the password must be re-entered if system parameters require changes.

The default passwords for level 1 and level 2 are “1111” and “2222”, respectively. There are no alternate passwords or “backdoors” for accessing the system. **A forgotten password may require a new master controller board, at customer expense.**

System control parameters are stored in non-volatile memory and will not be erased when power is removed for the master control unit. However, if a new program EPROM is installed or a different device model selected, the system control parameters will be re-initialized to the factory default settings.

Eleven LEDs are provided on the front panel of the control unit to indicate system status. Three LEDs grouped together vertically provide overall system status; they are “MAJOR”, “MINOR”, and “NORMAL”, indicating the presence of a major alarm, a minor alarm, or normal operation. The other eight LEDs correspond to the active state of each of the alarm output relays and are labeled “ALM1” . . . “ALM6”, “MIN”, and “MAJ”.

6.2 SNMP Interface

In addition, the unit’s controller incorporates a 10-base T Ethernet connection to allow remote access to the system signals, and remote control of certain aspects of its operation. APC’s Manual #991-0181 in the form of a CDROM will allow users to set up interface with the user’s Information Technology System. Simple Network Management Protocol (SNMP) version 1 is supported along with telnet protocol.

6.3 External Alarm Inputs

The four external alarm inputs (also referred to as “Input Relay Alarms”) can be assigned a priority and routed or “mapped” to alarm output relays. Available assignments are “Ignore”, “Major”, “Minor”, and “Relay 1” . . . “Relay 6”. Screens for making the assignments are located at **[SYSTEM/IN-RLY/RLY-MAP]**. This special menu notation is explained with an example in section 6.4

A user defined name or “alias” may also be assigned to each of these input alarms. Screens for making these assignments are located at **[SYSTEM/IN-RLY/ALIAS]**. For information on wiring connections to these inputs refer to Section 5.7.1.

6.4 Alarm Output Relays

There are eight alarm output relays designated Relay 1 through Relay 6, Minor, and Major, respectively. Various system parameters may be programmed to activate any of these alarm relays when set thresholds are exceeded or specific conditions occur. The first six relays can also be assigned a priority and routed or “mapped” to other output alarm relays. Available assignments are “Ignore”, “Major”, “Minor”, and “Relay 1” . . . “Relay 6”. Screens for making these assignments are located at **[SYSTEM/OUT-RLY/RLY-MAP]**. This feature makes it possible for a single alarm condition to activate multiple alarm output relays including the Minor or Major alarm relay. A user defined name or “alias” may also be assigned to each of the eight output relay alarms. Screens for making these assignments are located at **[SYSTEM/OUT-RLY/ALIAS]**. For information on making wiring connections to the alarm output relays refer to Section 5.7.2.

6.5 Parameter Locations, Descriptions, and Default Values

The location, description, and factory programmed default value for each of the MX28B system parameters is found in Table 6-1. The table also shows all of the status and information screens with typical displays. The location of a parameter screen is shown in brackets, for example:

[SYSTEM/IN-RLY/RLY-MAP]. To find the parameters that can be accessed in this category, starting from the main menu screen, do the following:

- 1) Use the right or left arrow keys to position the cycling cursor below “SYSTEM”.
- 2) Press the down arrow key once.
- 3) Use the right arrow key to position the cycling cursor below “IN-RLY”.
- 4) Press the down arrow key once; the cursor will be cycling below “RLY-MAP”.
- 5) Press the down arrow key (repeatedly if necessary) until the desired parameter screen is displayed (there are eight parameter screens in this category).
- 6) After making any desired changes (refer to Section 6.1 for the procedure), to return to the main menu press the up arrow key repeatedly.

If a parameter requires a level 1 or level 2 security access to permit changes to it, the security level will be found in braces, i.e. {2}, in the “PARAMETER” column of Table 6-1.

The complete menu structure shown in the order in which it is accessed from the control unit display is presented in outline form in Figure 6.2. Each indentation to the right represents a menu level below the indicated title.

Figure 6-2. Control Unit Menu Structure

```
MX28B120024V  +
STATUS
  Sys Voltage
  Sys Current
  Conv Voltage
  Conv Current
  Sys Temp
  Batt Current
  Batt Temp
ALARMS
  Alarm Item 1
  Alarm Item 2
  Alarm Item 3
  Alarm Item 4
  Alarm Item 5
  Alarm Item 6
  Alarm Item 7
  Alarm Item 8
  Alarm Item 9
  Alarm Item 10
  Alarm Item 11
  Alarm Item 12
  Alarm Item 13
  Alarm Item 14
  Alarm Item 15
  Alarm Item 16
SYSTEM
  SET-ALM
    Sys HV Thr
    Sys HV Alm
    Sys LV Thr
    Sys LV Alm
    Conv HV Thr
    Conv HV Alm
    Conv LV Thr
    Conv LV Alm
    Rect Cfg Alm
    Rect 1ofN Alm
    Rect 2ofN Alm
    Conv Cfg Alm
    Conv 1ofN Alm
    Conv 2ofN Alm
    Sys HT Thr
    Sys HT Alm
    Sys LT Thr
    Sys LT Alm
    Hw Sys V Alm
    Hw Cnv V Alm
    Hw Batt C Alm
```

(Figure 6-2. Control Unit Menu Structure)

```

    Hw Batt T Alm
    Hw Sys T Alm
    Hw LVD1 Alm
    Hw LVD2 Alm
  SETUP
    PIN 1
    PIN 2
    Address 1

    Address 2
    Address 3
    Model
    Fahrenheit
    Cntrl Rev
    FW Version
    Display Type
  DATE
    Date
    Time
  OUT-RLY
    RLY-MAP
      Out-Rly 1 Alm
      Out-Rly 2 Alm
      Out-Rly 3 Alm
      Out-Rly 4 Alm
      Out-Rly 5 Alm
      Out-Rly 6 Alm
      Out-Rly 1 Dly
      Out-Rly 2 Dly
      Out-Rly 3 Dly
      Out-Rly 4 Dly
      Out-Rly 5 Dly
      Out-Rly 6 Dly
    ALIAS
      Out-Rly 1
      Out-Rly 2
      Out-Rly 3
      Out-Rly 4
      Out-Rly 5
      Out-Rly 6
      Relay Minor
      Relay Major
  IN-RLY
    RLY-MAP
      In-Rly 1 Alm
      In-Rly 2 Alm
      In-Rly 3 Alm
      In-Rly 4 Alm

```

(Figure 6-2. Control Unit Menu Structure)

ALIAS

In-Rly 1
In-Rly 2
In-Rly 3
In-Rly 4

DIAG

Store Cfg
Lamp Test
Test Relay En
Test Relay 1
Test Relay 2
Test Relay 3
Test Relay 4
Test Relay 5
Test Relay 6
Test Min Rly
Test Maj Rly

MODULES

RECT

SET-ALM

Rect CL Alm
Rect Stdbym Alm
Rect FF Alm
Rect RFA Alm

PARAM

Rect Fail Safe
Rect Fail Comm

INFO

Rect # Curr
Rect # CL
Rect # Stdbym
Rect # FF
Rect # RFA

Conv

SET-ALM

Conv CL Alm
Conv Stdbym Alm
Conv FF Alm
Conv CFA Alm

PARAM

Conv Fail Safe
Conv Fail Comm

INFO

Conv # Curr
Conv # CL
Conv # Stdbym
Conv # FF
Conv # CFA

(Figure 6-2. Control Unit Menu Structure)

```

CIRBKR
  SET-ALM
    Cir Bkr 1 Alm
    Cir Bkr 2 Alm
    Cir Bkr 3 Alm
    Cir Bkr 4 Alm
    Cir Bkr 5 Alm
    Cir Bkr 6 Alm
    .
    .
    .
    Cir Bkr 70 Alm
    Cir Bkr 71 Alm
    Cir Bkr 72 Alm
  ALIAS
    Cir Bkr 1
    Cir Bkr 2
    Cir Bkr 3
    Cir Bkr 4
    Cir Bkr 5
    Cir Bkr 6
    Cir Bkr 7
    Cir Bkr 8
    .
    .
    .
    Cir Bkr 70
    Cir Bkr 71
    Cir Bkr 72
  FUSE
    SET-ALM
      FUSE 1 Alm
      FUSE 2 Alm
      FUSE 3 Alm
      FUSE 4 Alm
      FUSE 5 Alm
      FUSE 6 Alm
      FUSE 7 Alm
      FUSE 8 Alm
      FUSE 9 Alm
      FUSE 10 Alm
      FUSE 11 Alm
      FUSE 12 Alm
      FUSE 13 Alm
      FUSE 14 Alm
      FUSE 15 Alm
      FUSE 16 Alm

```

(Figure 6-2. Control Unit Menu Structure)

```

    ALIAS
        FUSE 1
        FUSE 2
        FUSE 3
        FUSE 4
        FUSE 5
        FUSE 6
        FUSE 7
        FUSE 8
        FUSE 9
        FUSE 10
        FUSE 11
        FUSE 12
        FUSE 13
        FUSE 14
        FUSE 15
        FUSE 16
LVD
    SET-ALM
        LVD1 Option
        LVD1 Open Alm
        LVD2 Option
        LVD2 Open Alm
    PARAM
        LVD1 Trip
        LVD1 Reset
        LVD2 Trip
        LVD2 Reset
BATT
    SET-ALM
        Batt Disc Thr
        Batt Disc Alm
        Batt HV Thr
        Batt HV Alm
        Batt LV Thr
        Batt LV Alm
        Batt HT Thr
        Batt HT Alm
        Batt LT Thr
        Batt LT Alm
    PARAM
        Batt Float
        Batt Max Rech
    COMP
        Comp Method
        Comp TC
        Comp HKnee
        Comp Lknee
```

(Figure 6-2. Control Unit Menu Structure)

PIN

PIN

OEM

OEM R Offset

OEM R Gain

OEM C Offset

OEM C Gain

OEM S Offset

OEM S Gain

Table 6-1. Parameter Locations, Descriptions, and Default Values

PARAMETER	DESCRIPTION	DISPLAY SCREENS / DEFAULT SETTINGS
SYSTEM SETUP		
Password Entry		
PIN Entry [PIN]	Screen for entry of the active password (PIN).	PIN m+ 0000
Password Setup		
Level 1 PIN {2} [SYSTEM/SETUP]	Password (PIN) that permits security Level 1 parameter changes - limited access.	PIN 1 m+ 1111
Level 2 Password {2} [SYSTEM/SETUP]	Password (PIN) that permits security Level 2 parameter changes - unlimited access.	PIN 2 m+ 2222
OEM Calibration		
OEM R Offset {2} [OEM]	Voltage offset adjustment for factory calibration of voltage readings/settings.	OEM R Offset m+ 0.000 V
OEM R Gain {2} [OEM]	Voltage gain adjustment for factory calibration of voltage readings/settings.	OEM R Gain m+ 1.000 V
OEM C Offset {2} [OEM]	Voltage offset adjustment for factory calibration of voltage readings/settings	OEM C Offset m+ 0.000 V
OEM C Gain {2} [OEM]	Voltage gain adjustment for factory calibration of voltage readings/settings.	OEM C Gain m+ 1.000 V
OEM S Offset {2} [OEM]	Current offset adjustment for factory calibration of battery current readings/settings.	OEM S Offset m+ 0.0 A
OEM S Gain {2} [OEM]	Current gain adjustment for factory calibration of battery current readings/settings.	OEM S Gain m+ 1.000 A
Site Address/Identification		
Address 1 {1} [SYSTEM/SETUP]	Power plant address or identification - first line.	Address 1 m+ APC
Address 2 {1} [SYSTEM/SETUP]	Power plant address or identification - second line.	Address 2 m+ 11035 Switzer Av
Address 3 {1} [SYSTEM/SETUP]	Power plant address or identification - third line.	Address 3 m+ Dallas, TX.
Control Unit Setup & Info.		
Model {2} [SYSTEM/SETUP]	Model name for the DC power plant “reset defaults” selection will re-initialize to factory settings for model selected	Model m+ MX28B 1200 24V
Temperature Scale {1} [SYSTEM/SETUP]	Enables selection of Fahrenheit or Celsius temperature scale (Fahrenheit “OFF” displays readings in °C).	Fahrenheit m+ OFF
Control Unit Revision [SYSTEM/SETUP]	Hardware revision level of the control unit.	Cntrl Rev + 000002
Firmware Version [SYSTEM/SETUP]	Version number of the control unit firmware. NOTE: Actual firmware version number displayed is the current version as of the date of manufacture.	FW Version + 000131

PARAMETER	DESCRIPTION	DISPLAY SCREENS / DEFAULT SETTINGS
Display Type [SYSTEM/SETUP]	Type number for the control unit display.	Display Type + 000255
Date/Time Setup		
Date {1} [SYSTEM/DATE]	Internal system calendar date.	Date m+ DEC 16 1999
Time {1} [SYSTEM/DATE]	Internal system clock time (24-hour format).	Time m+ 9:00:25
Alarm Threshold Setup		
High Voltage Threshold {1} [SYSTEM/SET-ALM]	System High voltage alarm threshold.	Sys HV Thr m+ 28.00 V
Low Voltage Threshold {1} [SYSTEM/SET-ALM]	System Low voltage alarm threshold.	Sys LV Thr m+ 25.00 V
High Voltage Threshold {1} [SYSTEM/SET-ALM]	Converter High voltage alarm threshold.	Conv HV Thr m+ -52.00 V
Low Voltage Threshold {1} [SYSTEM/SET-ALM]	Converter Low voltage alarm threshold.	Conv LV Thr m+ -48.00 V
High Temperature Threshold {1} [SYSTEM/SET-ALM]	Over temperature alarm threshold.	Sys HT Thr m+ 70.0 C
Low Temperature Threshold {1} [SYSTEM/SET-ALM]	Under temperature alarm threshold.	Sys LT Thr m+ 0.0 C
System Status		
System Voltage [STATUS]	System output voltage measured between the MX28B DC power plant +27V and return buses.	Sys Voltage + 27.00 V
System Current [STATUS]	The total system output current (calculated as the sum of the individual rectifier output currents).	Sys Current + 1120.8 A
Converter Voltage [STATUS]	Converter output voltage measured between the MX28B DC power plant -48V and return buses.	Conv Voltage + -50.00 V
Converter Current [STATUS]	The total converter output current (calculated as the sum of the individual converter output currents).	Conv Current + 68.2 A
System Temperature [STATUS]	System temperature measured within the control unit. Note: Will read about -156° C with no probe attached	Sys Temp + 25.2 C
Battery Current [STATUS]	Battery current measured at the current shunt.	Batt Current + 15.0 A
Battery Temperature [STATUS]	Battery temperature measured by the optional battery temperature sensor probe.	Batt Temp + 25.2 C
System Alarms		
System High Voltage {1} [SYSTEM/SET-ALM]	System voltage is above the high voltage threshold.	Sys HV Alm m+ Minor
System Low Voltage {1} [SYSTEM/SET-ALM]	System voltage is below the low-voltage threshold.	Sys LV Alm m+ Minor
Converter High Voltage {1} [SYSTEM/SET-ALM]	Converter voltage is above the high voltage threshold	Conv HV Alm m+ Minor

Converter Low Voltage {1} [SYSTEM/SET-ALM]	Converter voltage is below the low-voltage threshold.	Conv LV Alm m+ Minor
System High Temperature {1} [SYSTEM/SET-ALM]	The control unit temperature is above the high temperature threshold.	Sys HT Alm m+ Minor
System Low Temperature {1} [SYSTEM/SET-ALM]	The control unit temperature is below the low temperature threshold.	Sys LT Alm m+ Minor
Rectifier Configuration {1} [SYSTEM/SET-ALM]	The rectifier configuration differs from its stored configuration.	Rect Cfg Alm m+ Minor
Rectifier Fail 1-of-N {1} [SYSTEM/SET-ALM]	Rectifier Fail 1-of-N alarm - one rectifier has at least one alarm condition.	Rect 1ofN Alm m+ Minor
Rectifier Fail 2-of-N {1} [SYSTEM/SET-ALM]	Rectifier Fail 2-of-N alarm – two or more rectifiers have at least one alarm condition each.	Rect 2ofN Alm m+ Major
Converter Configuration {1} [SYSTEM/SET-ALM]	The converter configuration differs from its stored configuration.	Conv Cfg Alm m+ Minor
Converter Fail 1-of-N {1} [SYSTEM/SET-ALM]	Converter Fail 1-of-N alarm - one rectifier has at least one alarm condition.	Conv 1ofN Alm m+ Minor
Converter Fail 2-of-N {1} [SYSTEM/SET-ALM]	Converter Fail 2-of-N alarm – two or more rectifiers have at least one alarm condition each	Conv 2ofN Alm m+ Major
Hardware System Voltage {2} [SYSTEM/SET-ALM]	This alarm indicates there is a hardware failure in the system voltage monitoring function.	Hw Sys V Alm m+ Minor
Converter System Voltage {2} [SYSTEM/SET-ALM]	This alarm indicates there is a hardware failure in the converter voltage monitoring function.	Hw Cnv V Alm m+ Minor
Hardware Battery Current {2} [SYSTEM/SET-ALM]	This alarm indicates there is a hardware failure in the battery current monitoring function.	Hw Batt C Alm m+ Minor
Hardware Battery Temperature {2} [SYSTEM/SET-ALM]	This alarm indicates there is a hardware failure in the battery temperature monitoring function.	Hw Batt T Alm m+ Minor
Hardware System Temperature {2} [SYSTEM/SET-ALM]	This alarm indicates there is a hardware failure in the system temperature monitoring function.	Hw Sys T Alm m+ Minor
Hardware LVD1 {2} [SYSTEM/SET-ALM]	This alarm indicates there is a conflict between the commanded and sensed positions of the LVD1.	Hw LVD1 Alm m+ Minor
Hardware LVD2 {2} [SYSTEM/SET-ALM]	This alarm indicates there is a conflict between the commanded and sensed positions of the LVD2.	Hw LVD2 Alm m+ Minor
SYSTEM ALARMS DISPLAY		
Alarms Item 1 [ALARMS]	Display of up to 16 active alarms (a typical alarm screen is shown).	Alarm Item 1 + Batt LV Alm On m
•	•	•
•	•	•
Alarms Item 16 [ALARMS]	Display of up to 16 active alarms (a typical alarm screen is shown).	Alarm Item 16 +
SYSTEM DIAGNOSTICS		
Store Configuration {1} [SYSTEM/DIAG]	Setting this parameter to “Enable” will cause the current rectifier configuration to be stored (the display toggles back to “Disable” after entry).	Store Cfg m+ Disable
Lamp Test {1} [SYSTEM/DIAG]	Setting Lamp Test to “ON” will turn on the “MAJOR”, “MINOR”, “NORMAL”, “MAJ”, and “MIN” LEDs on the control unit front panel.	Lamp Test m+ OFF

Test Relay Enable {1} [SYSTEM/DIAG]	This parameter must be set to “Enable” to permit the eight output relays to be manually tested; otherwise, the state of the relays will be per system conditions.	Test Relay En m+ Disable
Test Relay 1 {1} [SYSTEM/DIAG]	Setting this parameter to “ON” energizes Relay 1 and turns on the “ALM1” LED on the control unit front panel.	Test Relay 1 m+ OFF
• • •	• • •	• • •
Test Relay 6 {1} [SYSTEM/DIAG]	Setting this parameter to “ON” energizes Relay 6 and turns on the “ALM6” LED on the control unit front panel.	Test Relay 6 m+ OFF
Test Minor Relay {1} [SYSTEM/DIAG]	Setting this parameter to “ON” energizes the Minor Relay and turns on the “MIN” LED on the control unit front panel.	Test Min Rly m+ OFF
Test Major Relay {1} [SYSTEM/DIAG]	Setting this parameter to “ON” de-energizes the Major Relay and turns on the “MAJ” LED on the control unit front panel.	Test Maj Rly m+ OFF
BATTERY SETUP		
Float Voltage {1} [BATT/PARAM]	Float voltage at 25°C battery temperature.	Batt Float m+ 27.00 V
Maximum Recharge Current {1} [BATT/PARAM]	Maximum battery recharge current (the system limits the charging current to this programmable value).	Batt Max Rech m+ 100A
Compensation Method {1} [BATT/COMP]	Activate “000001” or de-activate “000000” battery temperature compensation.	Comp Method m+ 000000
Temperature Compensation {1} [BATT/COMP]	Temperature compensation between low knee and high knee in mV/cell/°C. (Compensation equals zero at 25°C.)	Comp TC m+ - 3.00mV
Compensation High Knee {1} [BATT/COMP]	The temperature compensation high knee is the point above which there is no additional battery voltage compensation for further increases in temperature.	Comp Hknee m+ 40.0 C
Compensation Low Knee {1} [BATT/COMP]	The temperature compensation low knee is the point below which there is no additional battery voltage compensation for further decreases in temperature.	Comp Lknee m+ 0.0 C
Discharge Threshold {1} [BATT/SET-ALM]	An alarm is generated if the battery discharge current exceeds this value.	Batt Disc Thr m+ 100 A
High Voltage Threshold {1} [BATT/SET-ALM]	An alarm is generated if the magnitude of the battery voltage rises above this value.	Batt HV Thr m+ 28.00 V
Low Voltage Threshold {1} [BATT/SET-ALM]	An alarm is generated if the magnitude of the battery voltage drops below this value.	Batt LV Thr m+ 22.00 V
High Temperature Threshold {1} [BATT/SET-ALM]	An alarm is generated if the battery temperature exceeds this value.	Batt HT Thr m+ 70.0 C
Low Temperature Threshold {1} [BATT/SET-ALM]	An alarm is generated if the battery temperature drops below this value.	Batt LT Thr m+ 0.0 C

(Table 6-1. Parameter Locations, Descriptions, and Default Values)

PARAMETER	DESCRIPTION	DISPLAY SCREENS / DEFAULT SETTINGS
Battery Alarms		
Discharge Alarm {1} [BATT/SET-ALM]	An alarm that is generated if the battery discharge current exceeds the programmed battery discharge threshold.	Batt Disc Alm m+ Minor
High Voltage Alarm {1} [BATT/SET-ALM]	An alarm that is generated if the magnitude of the battery voltage rises above the high voltage threshold.	Batt HV Alm m+ Minor
Low Voltage Alarm {1} [BATT/SET-ALM]	An alarm that is generated if the magnitude of the battery voltage drops below the low voltage threshold.	Batt LV Alm m+ Minor
High Temperature Alarm {1} [BATT/SET-ALM]	An alarm that is generated if the battery temperature exceeds the high temperature threshold.	Batt HT Alm m+ Minor
Low Temperature Alarm {1} [BATT/SET-ALM]	An alarm that is generated if the battery temperature drops below the low temperature threshold.	Batt LT Alm m+ Minor
RECTIFIER SETUP		
Fail Safe Voltage {1} [MODULES/RECT/PARAM]	Rectifier default output voltage if communication with the control unit fails.	Rect Fail Safem+ 27.00 V
Communications Timeout {1} [MODULES/RECT/PARAM]	The maximum rectifier communications response time allowed before a communications failure is declared.	Rect Fail Comm+ 1 min
Rectifier Information	NOTE: This information can be viewed for each rectifier installed by using the horizontal arrow keys.	
Rectifier Current [MODULES/RECT/INFO]	A display of the DC output current for the individual rectifier.	Rect 1 Curr # 24.9 A
Current Limit Alarm [MODULES/RECT/INFO]	The status will be “ON” if the rectifier has been forced into its current limited mode.	Rect 1 CL # OFF
Standby Alarm [MODULES/RECT/INFO]	The status will be “ON” if the control unit is holding the rectifier in the standby mode.	Rect 1 Stdby # OFF
Fan Fail Alarm [MODULES/RECT/INFO]	The status will be “ON” if the rectifier fan has failed.	Rect 1 FF # OFF
Rectifier Fault Alarm (RFA) [MODULES/RECT/INFO]	The status will be on if the rectifier output has failed.	Rect 1 RFA # OFF
Rectifier Alarms		
Current Limit Alarm {1} [MODULES/RECT/SET-ALM]	This alarm indicates that a rectifier has been forced into the current limited mode.	Rect CL Alm m+ n of N

(Table 6-1. Parameter Locations, Descriptions, and Default Values)

PARAMETER	DESCRIPTION	DISPLAY SCREENS / DEFAULT SETTINGS
Standby Alarm {1} [MODULES/RECT/SET-ALM]	This alarm indicates that the control unit is holding a rectifier in the standby mode.	Rect Stdbby Almm+ n of N
Fan Fail Alarm {1} [MODULES/RECT/SET-ALM]	This alarm indicates that a rectifier fan has failed.	Rect FF Alm m+ n of N
RFA Alarm {1} [MODULES/RECT/SET-ALM]	This alarm indicates that a rectifier output has failed.	Rect RFA Alm m+ n of N
CONVERTER SETUP		
Fail Safe Voltage {1} [MODULES/CONV/PARAM]	Converter default output voltage if communication with the control unit fails.	Conv Fail Safem+ -50.00 V
Communications Timeout {1} [MODULES/CONV/PARAM]	The maximum converter communications response time allowed before a communications failure is declared.	Conv Fail Comm+ 1 min
Converter Information	NOTE: This information can be viewed for each converter installed by using the horizontal arrow keys.	
Converter Current [MODULES/CONV/INFO]	A display of the DC output current for the individual Converter.	Conv 1 Curr # 7.9 A
Current Limit Alarm [MODULES/CONV/INFO]	The status will be "ON" if the Converter has been forced into its current limited mode.	Conv 1 CL # OFF
Standby Alarm [MODULES/CONV/INFO]	The status will be "ON" if the control unit is holding the Converter in the standby mode.	Conv 1 Stdbby # OFF
Fan Fail Alarm [MODULES/CONV/INFO]	The status will be "ON" if the Converter fan has failed.	Conv 1 FF # OFF
Converter Fault Alarm (CFA) [MODULES/CONV/INFO]	The status will be on if the Converter output has failed.	Conv 1 CFA # OFF
Converter Alarms		
Current Limit Alarm {1} [MODULES/CONV/SET-ALM]	This alarm indicates that a converter has been forced into the current limited mode.	Conv CL Alm m+ n of N
Standby Alarm {1} [MODULES/CON/SET-ALM]	This alarm indicates that either the control unit is holding a converter in the standby mode or an operator has set a converter to standby	Conv Stdbby Almm+ n of N
Fan Fail Alarm {1} [MODULES/CON/SET-ALM]	This alarm indicates that a converter fan has failed.	Conv FF Alm m+ n of N
CFA Alarm {1} [MODULES/CON/SET-ALM]	This alarm indicates that a converter output has failed.	Conv CFA Alm m+ n of N
CIRCUIT BREAKER SETUP		
Breaker 1 Alias {1} [MODULES/CIRBKR/ALIAS]	An alternate name (alias) that can be assigned to a circuit breaker if desired.	Cir Bkr 1 m+ +24V
• •	• •	• •

•	•	•
Breaker 72 Alias {1} [MODULES/CIRBKR/ALIAS]	An alternate name (alias) that can be assigned to a circuit breaker if desired.	Cir Bkr 72 m+ +24V
Circuit Breaker Alarms		
Breaker 1 Tripped {1} [MODULES/CIRBKR/SET-ALM]	An alarm that indicates Circuit Breaker 1 is tripped.	Cir Bkr 1 Alm m+ Major
• • •	• • •	• • •
Breaker 72 Tripped {1} [MODULES/CIRBKR/SET-ALM]	An alarm that indicates Circuit Breaker 24 is tripped.	Cir Bkr 72 Almm+ Major
FUSE SETUP		
Fuse 1 Alias {1} [MODULES/FUSE/ALIAS]	An alternate name (alias) that can be assigned to a Fuse 1 if desired.	FUSE 1 + +24V
• • •	• • •	• • •
Fuse 16 Alias {1} [MODULES/FUSE/ALIAS]	An alternate name (alias) that can be assigned to a Fuse 16 if desired.	FUSE 16 + +24V
FUSE Fuse Alarms		
Fuse 1 Blown {1} [MODULES/FUSE/SET-ALM]	An alarm that indicates Fuse 1 is blown.	FUSE 1 Alm m+ Major
• • •	• • •	• • •
Fuse 16 Blown {1} [MODULES/FUSE/SET-ALM]	An alarm that indicates Fuse 16 is blown.	FUSE 16 Alm m+ Major
INPUT RELAY SETUP		
Input Relay 1 Alias {1} [SYSTEM/IN-RLY/ALIAS]	An alternate name (alias) can be assigned to the relay if desired.	In-Rly 1 m+ Input Relay 1
• • •	• • •	• • •
Input Relay 4 Alias {1} [SYSTEM/IN-RLY/ALIAS]	An alternate name (alias) can be assigned to the relay if desired.	In-Rly 4 m+ Input Relay 4
Input Relay Alarms		
Input Relay 1 {1} [SYSTEM/IN-RLY/RLY-MAP]	An alarm activated in response to an external contact closure or opening at the Input Relay 1 connection.	In-Rly 1 Alm m+ Ignore
• • •	• • •	• • •

Input Relay 4 {1} [SYSTEM/IN-RLY/RLY-MAP]	An alarm activated in response to an external contact closure or opening at the Input Relay 4 connection.	In-Rly 4 Alm m+ Ignore
OUTPUT RELAY SETUP		
Output Relay 1 Alias {1} [SYSTEM/OUT-RLY/ALIAS]	An alternate name (alias) can be assigned to the relay if desired.	Out-Rly 1 m+ Relay 1
• • •	• • •	• • •
Output Relay 6 Alias {1} [SYSTEM/OUT-RLY/ALIAS]	An alternate name (alias) can be assigned to the relay if desired.	Out-Rly 6 m+ Relay 6
Output Relay Minor Alias {1} [SYSTEM/OUT-RLY/ALIAS]	An alternate name (alias) can be assigned to the relay if desired.	Relay Minor m+ Minor
Output Relay Major Alias {1} [SYSTEM/OUT-RLY/ALIAS]	An alternate name (alias) can be assigned to the relay if desired.	Relay Major m+ Major
Output Relay 1 Delay {1} [SYSTEM/OUT-RLY/RLY-MAP]	Delay between sensing of the alarm condition and activation of the alarm relay. An alarm condition must exist for longer than the delay to be activated.	Out-Rly 1 Dly m+ 0 sec
• • •	• • •	• • •
Output Relay 6 Delay {1} [SYSTEM/OUT-RLY/RLY-MAP]	Delay between sensing of the alarm condition and activation of the alarm relay. An alarm condition must exist for longer than the delay to be activated.	Out-Rly 6 Dly m+ 0 sec
Output Relay Alarms		
Output Relay 1 {1} [SYSTEM/OUT-RLY/RLY-MAP]	Output Relay 1 alarm can be “mapped” to activate other output relays (“Ignore” activates no additional relays).	Out-Rly 1 Alm m+ Ignore
• •	• •	• •
Output Relay 6 {1} [SYSTEM/OUT-RLY/RLY-MAP]	Output Relay 6 alarm can be “mapped” to activate other output relays (“Ignore” activates no additional relays).	Out-Rly 6 Alm m+ Ignore
LVD SETUP		
LVD1 Trip {1} [MODULES/LVD/PARAM]	LVD1 trip (disconnect) threshold voltage.	LVD1 Trip m+ 21.00 V
LVD1 Restore {1} [MODULES/LVD/PARAM]	LVD1 restore (reconnect) threshold voltage.	LVD1 Reset m+ 24.00 V
LVD2 Trip {1} [MODULES/LVD/PARAM]	LVD2 trip (disconnect) threshold voltage.	LVD2 Trip m+ 21.00 V
LVD2 Restore {1} [MODULES/LVD/PARAM]	LVD2 restore (reconnect) threshold voltage.	LVD2 Reset m+ 24.00 V

LVD Alarm		
LVD1 Option {1} [MODULES/LVD/SET-ALM]	Set to “Enable” if the unit has an LVD1.	LVD1 Option m+ Enable
LVD1 Alarm {1} [MODULES/LVD/SET-ALM]	Sets the priority or “mapping” of an LVD1 Alarm.	LVD1 Open Alm m+ Minor
LVD2 Option {1} [MODULES/LVD/SET-ALM]	Set to “Enable” if the unit has an LVD2.	LVD2 Option m+ Enable
LVD2 Alarm {1} [MODULES/LVD/SET-ALM]	Sets the priority or “mapping” of an LVD2 Alarm.	LVD2 Open Alm m+ Minor